2015

Starting a Research Data Management Program Based in a University Library

Margaret Henderson
Virginia Commonwealth University, mehenderson@vcu.edu

Teresa L. Knott
Virginia Commonwealth University, tlknott@vcu.edu

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ABSTRACT. As the need for research data management grows, many libraries are considering adding data services to help with the research mission of their institution. The VCU Libraries created a position and hired a director of research data management in September 2013. The position was new to the libraries and the university. With the backing of the library administration, a plan for building relationships with VCU faculty, researchers, students, service and resource providers, including grant administrators, was developed to educate and engage the community in data management plan writing and research data management training.

KEYWORDS. Data management plans, data services, research data management

Authors.

Margaret E. Henderson, MLIS, AHIP (mehenderson@vcu.edu) is Associate Professor and Director, Research Data Management, VCU Libraries, Virginia Commonwealth University, 509 North 12th Street, P.O. Box 980582, Richmond, VA 23298-0582.

Teresa L. Knott, MLS, MPA, AHIP (tlknott@vcu.edu) is Director, Tompkins-McCaw Library and Associate University Librarian, VCU Libraries, Virginia Commonwealth University, 509 North 12th Street, P.O. Box 980582, Richmond, VA 23298-0582.

Acknowledgements

M. E. Henderson is partially supported by the National Institute on Aging of the National Institutes of Health under Award Number R01AG041823 (Informationist supplement RAG041823A). The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

INTRODUCTION

The late twentieth century saw the rise of computer use in science and research, especially in fields like genetics and physics. In the 1990s, there was a research data explosion with computers generating more and more data. Initially called e-science, these computer-intensive research methodologies, that required a good cyberinfrastructure, are now the norm.[1] As institutions and granting agencies began to understand the value of all the computer-generated data for reuse or discovery, the need for a standardized way to store and manage data became apparent. One of the first national, collaborative data initiatives was collecting and compiling DNA data into GenBank. Initially, the data was compiled in printed volumes before being made available digitally on CD-ROMs and through a web-based infrastructure. This was one way libraries initially became involved in the provision of data for research at some institutions. As Choudhury noted, data are publications and "academic research libraries represent the ideal home for long-term curation of large-scale datasets to support scholarly communication."[2]

Eventually, interest in data collected with government funds led groups to consider best practices for organizing data storage and curation. In the United States, the National Science Foundation (NSF) Digital Libraries Initiative from 1994-2003,[3] the National Institutes of Health (NIH) Data Sharing Policy in 2003,[4] and the 2006 Association of Research Libraries (ARL) report to the NSF, *To Stand the Test of Time: Long Term Stewardship of Digital Data Sets in Science and Engineering*,[2] laid the groundwork for digital and data initiatives. While open access to research data is a goal for many, similar to open access for publications, the variety of data types and formats makes easy access, reuse, and preservation challenging.[3]

Different models emerged to deal with data at institutions, depending on the personnel and structure of the organization. Generally, university technology services, libraries, research offices, or data-intensive departments or groups spearheaded initiatives to set up data services. Service was typically collaborative amongst these groups. Some of the larger programs today grew in fits and starts as new technology, new research methods, and new funder requirements changed the data landscape. The ARL RDM Spec Kit summary provides a good overview of the types of services and staffing models available in ARL member libraries.[4] Shen and Varvel described the development of data services at Johns Hopkins University libraries,[5] which provide storage, archiving, preservation, and curation of data. Gabridge examined the role of liaison librarians in the provision of RDM services.[6] The role of librarians and libraries varies from providing long-term storage and preservation to providing guidance on finding data for reuse and helping with DMPs. Initially, library data services were usually focused in the areas of social science data, geo-referenced data (GIS), and bioinformatics,[7] but libraries and librarians are taking on a larger, more active role in the life cycle of research data. Under President Barack Obama's administration, the Office for Science and Technology Policy (OSTP) issued a directive in February 2013,[8] followed by a memo and a plan that mandated data management plans and access to research data for federally funded research projects.[9] These federal directives provided the impetus for more institutions to create services to assist researchers in meeting these new requirements.

BACKGROUND

Virginia Commonwealth University (VCU) is a large, urban research university with over 30,000

students on two campuses and a library on each campus. The Tompkins-McCaw Library (TML) on the health sciences campus serves the professional schools in allied health, dentistry, medicine, nursing, and pharmacy, as well as researchers and graduate and post-doctoral students. The James Branch Cabell Library on the general academic campus serves a large undergraduate population, graduate students, faculty, and researchers in arts, humanities, engineering, sciences, and social sciences. Both libraries have active liaison librarian programs that serve as an excellent point of contact between faculty, students, and the libraries. The university is classified by Carnegie as a research university with very high research activity. Despite all the research, there were not centralized research data management services and little help could be found on VCU websites for campus groups in 2013.

In August 2013, VCU Libraries (VCUL) hired a Director for Research Data Management (DRDM), a new position for the libraries and the university. The DRDM reports to the Director of the Tompkins-McCaw Library for the Health Sciences, who is also an Associate University Librarian (AUL). When the DRDM position was recruited, anecdotal evidence from VCUL liaison librarians suggested there was a need for working and long-term computer storage space for researchers. In terms of technical infrastructure, VCU Technology Services (TS) provided some backed-up network storage for all faculty, staff, and students with options to purchase larger amounts of storage. VCUL had digital collections from archives and special collections, as well as electronic theses and dissertations. VCUL Digital Technologies managed the digital collections and were in the planning stages of adding an institutional repository (IR).

The DRDM and AUL created a plan that relied on the second-mover advantage. Hoppe studied the adoption of new technology under uncertainty and found that informational spillovers contributed to second-movers having an advantage over early adopters.[10] By learning from the

successes and mistakes of data management pioneers, some missteps could be avoided, some steps could be condensed or eliminated, and the time to set up a working service could be reduced.

A needs assessment survey is typically an important part of starting a data program, although it can be time consuming and expensive. The decision was made to forego the faculty survey on data management needs because there were already too many surveys running at the university, including an Educause survey on behalf of VCU TS and the Ithaka S+R Faculty Survey, which was to be administered in early 2014 on behalf of the VCU Libraries. With the second-mover advantage, it could be extrapolated that findings from needs assessments from other research universities would be similar to VCU. Articles documenting the data management needs of faculty and researchers could be used as a starting point. Westra interviewed 25 scientists at the University of Oregon and found data storage and backup to be the top data management issue.[11] Johnson, Butler, and Johnston compiled the results of four surveys at the University of Minnesota. Storage and the need for repositories came up in those surveys as well.[12] Parsons found that the top three areas of interest at the University of Nottingham were DMPs, storage, and cataloging/metadata.[13]

Disciplinary differences in data management have been studied. In their survey of over 300 Emory University faculty, Akers and Doty found statistically significant differences in research data management needs between four research domains: arts and humanities, social sciences, medical sciences, and basic sciences.[14] One interesting finding from Akers and Doty was similar concerns about confidentiality and privacy between social sciences and medical sciences. The Purdue Data Curation Profiles contain transcripts of extensive data interviews with numerous researchers from multiple institutions. By reviewing profiles in different subject areas,

the Purdue profiles can be used to understand discipline-specific research and data management needs.[15] Case studies in the literature can also be used to learn more about working with research data. For example, Marshall et al. wrote about managing a legacy public health dataset.[16] As well as using previous data survey results, older research on information-seeking behavior and information needs can be used to predict what will be helpful to different disciplines.[17] As Borgman indicated, current interdisciplinary research encourages groups to provide information that can be used by researchers in other fields as well as to create information that integrates practices from multiple disciplines.[3] These collaborations should start making researcher data needs more homogeneous.

The literature did not provide a single model that was ideal for setting up RDM services at VCU. Raboin, Reznik-Zellen, and Salo compared three institutions experiences and found that the common challenges were getting administrative support, staffing issues, and meeting evolving researcher needs.[18] The final report of the Association of European Research Libraries' LIBER E-Science working group provided a list of ten recommendations for libraries on starting research data management services. Data storage, data management plans (DMPs), metadata, data repositories, data management support, and cultivating relationships were some of the recommended steps to get started.[19]

THE PLAN

The initial plan was purposely broad to accommodate new information or opportunities that arose as the DRDM studied the data environment at the university. Rather than a specific action

plan, this broad plan was open to the needs of the researchers as the DRDM learned more about the faculty, researchers, staff, students, resources, and services around the institution.

Among the high priorities was creating a communication plan that included a web presence for discovery and reference. The DRDM worked with the VCUL public relations (PR) department to develop appropriate messaging and to create print promotional materials. A web presence and research guides were created as resource material. In tandem, the PR department promoted the creation of the DRDM position through press releases, newsletters, and online through VCU and VCUL websites and communication channels. Another priority of the DRDM was conducting an environmental scan for data and data management resources. As the DRDM carefully reviewed VCU websites for data/data management materials, she contacted people to learn more about services provided and compiled a resource list for research data management. She identified and recruited strategic partners with services and resources that researchers will need. It became clear in this process that some individuals were clearly territorial, and it was necessary for the DRDM to educate and reassure these individuals that the program was being created to meet service gaps, not to undermine or replace existing services. Because many data services started by assisting with NSF data management plans (DMPs), the decision was made to focus on picking this low hanging fruit. Existing and developing federal regulations and organizational requirements that promote data management are useful for leveraging support that librarians can provide to researchers. VCUL signed on as a DMPTool <http://dmptool.org> partner organization. Developed in 2011 by several university libraries and a few data organizations, the DMPTool provides data management plan templates that are customizable by partners for their organization and for different funding organizations such as the NSF. The DRDM promoted DMPTool use to faculty and grants administrators.

Communication and education underpin the VCUL action plan. The DRDM identified faculty, students, and administrators who were interested in data issues and looking for assistance. Through the identification, the DRDM formed collaborative relationships whenever possible. Key relationships formed included leaders in Technology Services and the University's Office of Research and Innovation. In terms of education, every conversation and interaction, whether about the creation of her position or about resources, was an opportunity for the DRDM to raise awareness of data management best practices. The DRDM purposely sought to engage colleagues, administration, faculty, staff, and students on the topic of research data management. She continues to teach classes for as many groups as possible. Even five minutes as part of an orientation session can be a start.

PLAN IMPLEMENTATION

The first year of any new service is one of discovery and testing. It is also a time to build relationships. Communication and education are ongoing. Online and print promotions of research data management services resulted in contacts from those seeking help with DMPs. These interactions led to use of the customized DMPTool, consultations, group presentations, and teaching opportunities.

Institutional Resources

The DRDM participated in the DuraSpace/CLIR E-Science Institute <http://www.duraspace.org/e-science-institute> with the AUL and an associate dean for

research. As part of the program, a SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis was completed to assess institutional resources. By reviewing the resources and services available through VCUL, VCU TS, and other divisions, gaps were identified in the resources and services needed for e-research and will be incorporated into future RDM planning. Valuable institutional resources identified are detailed below.

- The VCU Center for Clinical and Translational Research (CCTR), funded by a Clinical and Translational Science Award, can support most clinical and biomedical research with special regulations or federal mandates. The DRDM refers researchers to the CCTR when needed and assists with NIH Data Sharing Plans.
- The Biomedical Informatics Core in the CCTR makes resources available to all VCU researchers including RedCap. RedCap is a useful database and survey tool that is HIPAA compliant. At this time, there are no restrictions on data storage, but there is no easy sharing mechanism.
- Scholars Compass <http://scholarscompass.vcu.edu>, the new VCUL IR, includes data storage as a supplement to an article or as a separate item. Since the file size is limited to 2MB, the IR will not be a solution for all data sets. Guidelines for alternate repositories will be developed as funder mandates are clarified. Subject or national repositories may be more beneficial or appropriate for other data sets.
- VCU Technology Services provides backed-up storage on the network and through Google Drive (Apps for Education). This is adequate for most projects, but VCU TS continues to explore options for storage of large amounts of data. A future collaboration between RDM, TS, and the Office of Research and Innovation may involve developing a policy on including funding requests for data storage in grant proposals.

- The backing of library administration was and is very important. Starting any new service is challenging, but knowing the administration is supporting these efforts makes things much easier.

Supporting Grant Requirements

The DMPTool is a key tool for supporting grant requirements on data management. It is available at VCU and is being customized to help researchers find the resources needed to fulfill the data management requirements of funding agencies. Promoting the use of the DMPTool led to consultations with researchers in multiple subject areas working on NSF and NIH grants. In addition, the option of depositing data in Scholars Compass will provide a valuable resource for mandated sharing in areas with no disciplinary repositories.

Relationship Building / Strategic Partnerships

The efforts toward elevating the awareness of research data management services has resulted in strategic partnerships and new relationships with researchers. The flexibility of the plan allowed the DRDM to collaborate on a proposal in response to a National Library of Medicine (NLM) call for an administrative supplement award for informationist services in NIH-funded research projects. Seeking and recruiting a collaborator offered an opportunity for librarians to meet and work with new faculty members with large NIH grants. Over the next two years, receipt of the administrative supplement award will give an interdisciplinary librarian team excellent

experience in providing in-depth services, and institutionally will serve as a local example when describing the benefits of data management and other library services.

Another relationship-building opportunity arose when the Provost appointed the DRDM to the Data and Information Management Council (DIMC). This lead to further contacts in the university community who were focused on securing administrative data. A highlight of participating in the DuraSpace/CLIR E-Science Institute was the relationship that the DRDM and AUL developed with the assistant dean of research on the general academic campus. This relationship led to more comprehensive understanding of the University's research environment as well as insights into the organization of the University.

Internally, formal and informal discussions with liaison librarians on both campuses led to consultations and the opportunity to build relationships across the University. The development and launch of the VCU Libraries institutional repository, Scholars Compass, represented another opportunity. Scholars Compass training was open and widely advertised to the university community. Participants who asked about data were contacted by the RDM director for further information. Recently, this led to a collaboration with the VCU Rice Center for Environmental Life Sciences to create a new DMPTool template with GIS coordinates for all research taking place at the Center.

Education

While the line between communication and education can be blurred, education continues to be a core component of the action plan. Various communication pieces led to the opportunity to provide educational sessions. In response to interest in research data management training for

graduate students, the DRDM was invited to give the data lecture in the Responsible Conduct of Research course required of all graduate students.

As part of a VCUL work team on scholarly communications and the implementation of the institutional repository, the DRDM conducted a survey of library faculty knowledge of data and scholarly communication, using the survey from Bresnahan and Johnson.[20] The results of this survey indicated that library faculty would benefit from some data management training to help with VCU faculty interactions. Plans are in process to address this educational opportunity. The first New England Collaborative Data Management Curriculum (NECDMC) <http://library.umassmed.edu/necdmc/index> Train-the-Trainer workshop in November 2013 offered a second-mover opportunity. The DRDM will use the first module in an educational session for the library faculty. Currently, the DRDM is investigating the possibility of a for-credit graduate course in research data management based on the NECDMC.

THE PLAN MOVING FORWARD

A review of RDM websites shows the services offered include assistance with data collection, data processing, analysis of data, saving data for the long term, data curation, sharing data, finding data to reuse, depositing data in repositories, using GIS services, presenting data, designing research, collecting metrics to show the impact of shared data, writing data management plans for grants, and teaching best practices for data collection and use. Given that RDM services are new to VCU and that the department started with one person, it is important to prioritize the most important services upon which to focus. Results from the Ithaka S+R Faculty Survey showed that over 70% of faculty create data in the course of their research. Of this

group, almost 70% would find it valuable to have help from the library for managing and preserving data. It is an ideal time to be setting up data services.

Carlson distinguished between data management services that help researchers when they are actively working with data, versus data curation services, that help with long-term storage and use of the data collected.[21] While data sharing and open access (OA) discussions are very important, they may not be the best way to start a discussion with a faculty member who only sees the expense of publishing in an OA journal or the extra work needed to ensure compliance with the NIH Public Access Policy. Once the faculty member is engaged in conversation, then introducing the ideas of sharing, altmetrics, and long-term preservation can follow as the researcher realizes the value of his or her research data and the benefits of sharing. If researchers see the value of data management services, data curation will be easier to promote. Faculty demand will also make data curation services easier to promote to the university administration.

When starting data services, it is helpful to have a practical focus. The process of creating and maintaining basic information about research data management is ongoing, as are outreach efforts. With the availability of DMPTool 2.0, the focus will be supporting university research and scholarship by ensuring that VCU researchers and students have excellent, comprehensive data management plans for their grants and access to the necessary help for following those plans. The focus on data management plans and DMPTool customization to facilitate the writing of plans, dictates the resources and information that need to be collected and organized for grant writers.

The DMPTool will be the centerpiece for the DRDM to address the following. Data type or format will be used to develop educational sessions or materials on best practices for collecting data and establishing basic file structure. Discussions about storage will involve the

use of Google Drive for storage and sharing, other storage options available through VCU Technology Services, and networking and sharing options through organizations such as Dryad. These conversations will lead to education on standards for data collections, based on subject and community norms, and the importance of security that offers an opportunity to share the VCU data security policy which sets standards for types of storage based on data types. Through the DMPTool, the DRDM will have the opportunity to address issues related to sharing such as the importance of metadata, using an institutional repository or a subject-based repository, and the importance of having a Digital Object Identifier (DOI) or persistent URL assigned to enhance retrieval. It also provides a framework to consider federal and state requirements on data retention and sharing. It is a very versatile tool to lay a foundation for research data management services.

A graduate research assistant recently joined the department. His primary assignment is to develop a complete catalog of storage availability, network resources, sharing options, analysis services, database programs, and servers available for researchers through Technology Services, the Office of Research and Innovation, and the Center for Clinical and Translational Research. The Director for Research Data Management is focusing her efforts on:

1. Collaborating with research deans across VCU to educate faculty about DMPs and offer training for their staff and students.
2. Educating grant personnel on data requirements and informing them about the support available from the library.
3. Training graduate students in RDM collaboratively with the Graduate School so the students will be prepared to write DMPs for future grants and to manage their graduate research properly.

Many institutions also offer data curation services. The University of Illinois' Graduate School of Library and Information Science defined data curation as "the active and ongoing management of data through its life cycle of interest and usefulness to scholarship, science, and education. Data curation activities enable data discovery and retrieval, maintain its quality, add value, and provide for reuse over time, and this new field includes authentication, archiving, management, preservation, retrieval, and representation."[22] Being able to add value to data stored in the institutional repository or set up a plan to appraise, weed, and update formats of data in a repository is a worthy goal, but it is not an essential inaugural service when an institution is starting research data management services. The personnel and technology costs need to be considered before adding curation services to research data management services.

Knowledge of copyright, open access, and data citation practices is also important, but like the extended services mentioned above, they do not need to be the focus of the initial support services. Finding a focus and sticking to it when the staff and budget are small is important to making the service successful and establishing a niche.

CONCLUSION

Goben and Salo predict that the surge in openly available data caused by the OSTP memo will create demand for data-specific reference and instruction, not just help with data management plans.[23] The relationships developed to help with data management plans will be a good starting point for future services in the areas of data preservation, data citation, data reuse, and alternative metrics. Education and consultation in these areas fit well with the skill set of liaison librarians as well as data librarians.

Along with requirements for public access to publications and data, the OSTP memo mandated that all government granting agencies require a DMP similar to that required by NSF.[8] This means that the NIH and other agencies will need to move towards requiring a full DMP, not just a data sharing plan. Research data management services of some sort will need to be provided by any institutions receiving U.S. federal government funds, and libraries are well suited to contribute to the provision of these services. Data services are a natural extension of library services such as organizing files, categorizing material of many types so others can find them, describing data and files, and locating data (information) for researchers to reuse. Additionally, librarians have a strong tradition of outreach and education, so locating data services in libraries makes a lot of sense. Libraries are a centralized resource at most institutions where people go for assistance. New researchers and new students often start their search for information at the library. At the end of their report on ten recommendations to get started with RDM, the LIBER working group concluded: "There is no need for research libraries to start with all recommendations or to try to deliver a full spectrum of data services at once. Small steps will do."[24] This is the most important takeaway point for any group trying to set up data services.

A research data management librarian can help the university without the need to be a data scientist. Providing education about good data practices and assisting with DMPs for grants does not require extensive programming or statistical knowledge. Eventually it may be desirable for the RDM service to include help with programming and analysis, but basing the service on DMP requirements is one way to get started. Other institutions have and will use different services depending on the skills and capacity of their staff. McLure et al. suggested that librarians can leverage existing skills and expertise to help with education and outreach in data curation.[25] With the work done to this point on research data management, librarians can learn

from the RDM community, avoid pitfalls that have been problematic for others, and build on the foundations laid in research data management.

Received: September 2, 2014

Revised: October 17, 2014

Accepted: October 26, 2014

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